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IS 1448-125 (1987): Methods of Test for Petroleum and its Products, Part 125: Estimation of Deleterious Particles in Lubricating Grease [PCD 1: Methods of Measurement and Test for Petroleum, Petroleum Products and Lubricants]

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Indian Standard (Reaffirmed 2006)

METHODS OF TEST FOR PETROLEUM AND ITS PRODUCTS

[P : 125]

ESTIMATION OF DELETERIOUS PARTICLES IN LUBRICATING GREASE

UDC 665·6/·7 : 621·892 : 543·869

Adapted with permission from ASTM D 1404-83

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1. SCOPE

1.1 This method describes a procedure for the detection and estimation of deleterious particles in lubricating grease. A deleterious particle by this method is one which will scratch a polished plastic surface.

2. SUMMARY OF THE METHOD

2.1 The lubricating grease, being tested, is placed between two clean, highly polished acrylate plastic plates held rigidly and parallel to each other in metal holders. The assembly is pressed together squeezing the grease between the plastic plates to a thin layer. Any solid particles in the grease larger than the distance of separation of the plates and harder than the plastic will become imbedded in the opposing plastic surfaces. The apparatus is so constructed that one of the plates may be rotated about 30° with respect to the other while the whole assembly is under pressure. This will cause the imbedded particles to form characteristic arc-shaped scratches in one or both plates.

2.2 The relative number of such solid particles may be estimated by counting the total number of arc-shaped scratches on the two plates.

2.3 An advantage of this method is that it is rapid. Each test takes only a few minutes to run.

3. SIGNIFICANCE AND USE

3.1 The significance of the number of scratches, as far as correlation with field performance is concerned, has not been established. A

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particle which is abrasive to plastic may not necessarily be abrasive to steel or other bearing materials. Some correlation has been obtained in that the contaminant used in Sample 3 (*see* **7.1**) had a higher wear rate in a laboratory ball bearing abrasive wear test than the contaminant in Sample 2.

3.2 The method is applicable regardless of grease colour or fillers and may also be used for testing other semi-solid or heavy liquid substances.

4. APPARATUS

4.1 The test apparatus (*see* Note 1) is shown in Fig. 1. As illustrated in Fig. 1, the plastic test plates (*see* Note 2) (1) are rigidly held in a parallel position in square recesses in position (2) and (7). The holder (7) is part of the cap assembly, (7 to 11) which can be removed as a unit from the body (3) by means of four cap screws. The lower plate holder (2) can slide along the axis of the main housing, but it is restricted from turning by keys spaced 180° apart. Pressure is applied to the plastic plates through the holder (2) by means of the coil spring (4), spring follower plate (5) and loading screw (6). The large loading screw also serves as a base for the apparatus. The indicator pin (12) on the spring follower plate (5) shows the amount of spring compression which, in turn, is a measure of the pressure being applied between the two plastic plates. The upper holder (7) for the plastic plate may be rotated through about 30° while the plates are under pressure. Normally the holder (7) is kept from rotating by the threaded pin (9) which projects through a milled slot in cap (8) and ends in a wing nut (14). To rotate the upper plate and holder, the wing nut is loosened, and the handle (11) is turned. A leather washer (10) between holder (7) and cap (8) makes this turning easier.

NOTE 1 — The apparatus shown in Fig. 1 is available from Faville Levally Corp , 2055 Comprehensive Dr. Aurora, Il 60505, and from Koehler Instrument Co, Inc, 1595 Sycamore Ave, Bohemia, L. I., NY 11716.

NOTE 2 — The two common acrylate plastics made in uniform highly polished sheets are Plexiglas, made by Rohm & Hass Co, Independence Mall W., Philadelphia. PA , and Lucite made by the E. I. Du Pont de Nemours and Co, Wilmington DE.

5. PROCEDURE

5.1 With the tension completely off the spring, remove the cap assembly from the main housing by means of the four cap crews. Snap into the square recesses of each of the holders (2) and (7), (*see* Fig. 1), a 25 × 25 × 3·2 mm plastic plate with the protective paper still attached. Then remove this protective paper from the exposed side of each plastic plate. (The edges of these outer faces should be rounded just slightly with a smooth file. A sharp edge might cause scratches in the opposite plate). At this point, the two polished surfaces should be free of scratches and dust. Carefully remove any dust particles with a soft brush or damp chamois skin.

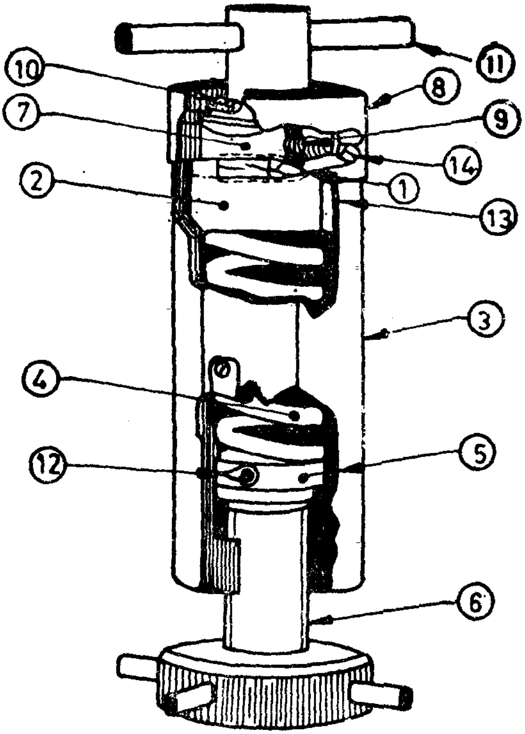

FIG. 1 CROSS-SECTION VIEW OF APPARATUS

5.2 Place a pea-size sample of the grease to be tested on the face of the lower plate. Bolt on the cap assembly and apply a pressure of approximately 1·38 MPa (14 kgf/cm^2) by turning the loading screw (*see* Note). With this pressure applied to the plates, loosen the locking nut on the stop in the cap assembly, and turn the handle at the top as far as it will go (about 30°). Then release the pressure by loosening the loading screw. Remove the cap assembly and the plastic plates carefully from their respective holders.

NOTE — The pressure applied to the plates determines the thickness of the grease layer between them. A pressure of 1·38 MPa (14 kgf/cm^2) gave a thinner layer than 0·69 MPa (7 kgf/cm^2), but increasing the pressure from 1·38 to 3·45 MPa (14 to 35 kgf/cm^2) caused very little change.

5.3 Number the test faces for identification, remove the protective paper from the backs and wash them in filtered naphtha. Handle these plastic test pieces very carefully to avoid scratches.

6. REPORT

6.1 Count and report the total number of scratches on the two plastic test plates. A magnifier or projection viwer may be used as an aid in counting. Figure 2 illustrates a test showing different degrees of scratching.

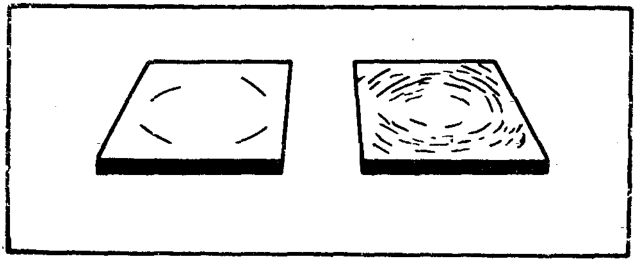

FIG. 2 PLASTIC TEST PLATES SHOWING DIFFERENT DEGREES OF SCRATCHING

7. PRECISION

7.1 A series of cooperative tests were run on three grease samples, two of which were artificially contaminated. The results from six different laboratories were as follows:

Sample	*Average Number of Scratches*	*Standard Deviation*
1	4	6
2	41	8
3	113	27

7.2 The number of scratches obtained cannot be used to draw fine differences between greases, but to rather group them into possibly three general classes. One such possible division could be:

Class 1 — Less than 10 scratches,
Class 2 — 10 to 40 scratches, and
Class 3 — Over 40 scratches.

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